DOCUMENT RESUME

ED 028 652 EM 007 196

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The Use of Field Data for Improving IPI Materials and Procedures.

Pub Date 8 Feb 69

Note-15p.; Paper presented at the Annual Convention of the American Educational Research Assn. (Los Angeles, California, February 5-8, 1969)

EDRS Price MF-$0.25 HC-$0.85

Descriptors-Classroom Materials, *Educational Objectives, *Evaluation Techniques, Individual Differences, Individual Instruction, *Individualized Instruction, Instructional Materials, Programed Instruction, *Program Evaluation, *Program Improvement, Student Evaluation, Teacher Evaluation

Identifiers-IPI, *Project Individually Prescribed Instruction

The Individually Prescribed Instruction (IPI) Project incorporates minute facilities for evaluating and improving its effectiveness constantly, where necessary, so that it may achieve its desired goals. A field test of IPI on 25 schools in the school year 1967-8 comprising three areas of inquiry emphasized this feature. The schools were tested and selected for how scrupulously they had applied the system and, this requirement satisfied, the methods of prescription setting were examined. This examination indicated where and how more variety could be achieved in the individual prescriptions for the children. An evaluation of the area of objectives revealed, not only redundancies, but also the fact that a test used for measuring an objective may itself need re-evaluation. Lastly, the effectiveness of lesson materials was tested and this showed that some materials were insufficient, and that the methods used for sampling some results were inadequate. Included is an appendix comprising materials and procedures used to obtain field data for the test. (GO)

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THE USE OF FIELD DATA FOR IMPROVING IPI MATERIALS AND PROCEDURES

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EM007196

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The Individually Prescribed Instruction Project represents an investigation into the requirements for and the problems encountered in developing a system for individualizing instruction. The definition of individualization used for IPI is that the individualization of instruction requires the adaptation of the educational environment to individual differences. The aims and goals of this project have been described previously and will not be repeated here. Also, the specification of the system to arrive at these goals has been described in several articles such as Glaser[1], Lindvall and Bolvin[2], and Bolvin and Glaser[3]. In all of the discussions of the elements of the IPI system, one important component that has relevance for the use of data in improving the program is that

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[1]Glaser, Robert. Adapting the elementary school curriculum to individual performance. In Proceedings of the 1967 Invitational Conference on Testing Problems. Princeton: Educational Testing Service, 1968. Pp. 3-36.

[2]Lindvall, C. Mauritz and Bolvin, John O. Programed instruction in the schools: An application of programing principles in "individually prescribed instruction." In Goodlad, John I. (Ed.), Sixty-Sixth Yearbook of the Nat'l. So. for the Study of Education. Chicago: University of Chicago Press, 1967. Pp. 217-254.

[3]Bolvin, John O. and Glaser, Robert. Developmental aspects of individually prescribed instruction. Audiovisual Instruction. Washington, D. C.: National Education Association, October, 1968.

the system has built into it strategies for information feedback in order to provide means for constant evaluation and improvement of the system.

Like other programs, IPI has a set of goals to be achieved. It has a plan to achieve these goals, and this plan has been put into operation to see if the stated plan does achieve the desired goals. For the past several years, the major concern of the developers of IPI has been the evaluation of the operation to determine where changes in elements of the system must be improved to make the operation consistent with the plan. For instance, five elements of the IPI plan are: 1) a testing program, 2) prescription writing procedures, 3) instructional materials and devices, 4) teacher classroom activities, and 5) classroom management procedures. Each of these elements has sub-elements that are expressed in terms of the plan and in terms of the operation.

Insert Figure 1 about here

During the school year 1967-68, IPI was field tested in approximately 25 schools throughout the country. During this field testing the developers collected information which could be used to determine where improvement was needed to make the operation more consistent with the plan. However, before using data for this purpose, it had to be determined whether or not the schools were in fact adopting and applying the system as designed. Miss Weinberger has addressed herself to this point previously. Once we had determined what schools represented true replications of the IPI model and hence could be used for data analysis, the

staff of the Learning Research and Development Center then selected the essential data to be analyzed. Examples of parts of the IPI operation for which data was gathered for this purpose are as follows:

1. Prescription writing. One of the essential requirements of the system is that prescriptions or plans vary from pupil to pupil depending upon individual differences. To determine whether this was happening, the prescription data was analyzed: first by objective, then by unit, and subsequently by age or grade.

Figure 2 is a modified version of the Prescription Form being used in the IPI system. Each teacher develops a prescription for each student in his class for each day or, at most, several days. The form itself is organized in such a way to provide the student and teacher with information relative to the student's progress, and secondly, to provide information for program evaluation. In the example of the question just asked, "Do plans vary from pupil to pupil depending upon individual differences?" the first step in arriving at an answer would be to determine if the plans varied from pupil to pupil. The Prescription Form provides some information relative to this question. In the lower right-hand corner of the form is the pretest information. This information is available for each objective within the unit before the student begins work in this unit. In the lower left-hand portion are alternative techniques and settings that can be prescribed. In the body of the prescription the teacher specifies the order of tasks, the techniques of instruction, and whose choice it was, the student's or the teacher's, that the student work on these tasks.

Insert Figure 2 about here

Sample data from the 25 schools for several objectives are given in Table I.

Insert Table I about here

In general, an examination of this information indicated that prescriptions did vary from child to child but there was more variation in terms of paper-pencil activities than there was with alternate settings or instructional techniques. This provided important information concerning needed modifications in the system to increase the probability of greater variations in prescriptions with respect to settings and techniques used. The Center is now attempting to provide more systematic procedures to assist the teacher in utilizing the alternatives available.

2. Objectives. Another question of interest to the system developers is whether all the objectives listed, for instance in the Math Curriculum, are necessary. An examination of the pretest data from the 25 schools for each of the 400 objectives in the Math program revealed that there was some objectives for which large numbers of students had proficiency at the time of the pretest. Table II is a summary of these data.

Insert Table II about here

Information of this type leads us to two considerations: 1) to question each objective as to the necessity for including it or as to its placement, 2) to question the test that is used to measure this objective. From the 1967-68 data, we found instances of both types of errors in the program.

3. Lesson materials. Another use of the information from the tryout schools was to determine some of the more serious problem areas in terms of materials available for student use. In addition to teacher comments and comments from the various monitors visiting the schools, we also analyzed the number of CET's and Posttests assigned for each objective. Table III is a sample of this type of information.

Insert Table III about here

These two units were used as examples since they represent units that were identified as particularly troublesome. In the unit D-Addition the students had very few problems in reaching the 85% proficiency on the CET's but seemed to have trouble reaching the desired proficiency on the first posttest. An examination of the materials, tests, and teacher comments indicated a need for the restructuring of the entire unit adding several missing objectives. In the case of E-Multiplication the major problems uncovered were: 1) inadequate materials for objectives 5, 8, 10, and 11; 2) missing objectives relating to the use of associative principle; and 3) inadequate sampling of desired outcomes on the posttest.

In summary, the information collected in the IPI system to assist the teacher and student in decision making relative to the child's progress is also useful information for assisting in the determination of whether the operation is consistent with the plan. During the school year 1966-67 with only 25 schools involved, it was possible to collect nearly all of the available data. However, as the number of schools increases we will become more and more involved with systematically sampling relevant data to continue the improvement of the materials and procedures necessary.

THE USE OF FIELD DATA FOR IMPROVING IPI MATERIALS AND PROCEDURES

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Figure 1

Plan and Operation for Selected Elements of the IPI System*

PLAN	OPERATION
A Testing Program that:	**The Testing Program:**
a. Provides information for proper placement in the instructional continua.	a. Is used to place pupils at correct points in the instructional continua.
b. Aids in the diagnosis of specific pupil needs.	b. Provides valid diagnosis of pupil needs.
c. Provides for frequent assessment of mastery.	c. Provides a valid assessment of mastery of objectives and of units.
d. Tests pupil on objectives and units when he is ready.	d. Is administered so that the pupil is taking CET's and unit tests at proper times.
e. Facilitates the planning of effective individualized programs.	e. Provides data that are found useful by the teachers for developing valid prescriptions.
f. Provides information that has real meaning to the student.	f. Provides data that are meaningful to the student.
Prescription Writing Procedures that:	**Instructional Prescriptions**
a. Are based upon valid and meaningful diagnoses.	a. Are based upon proper use of test results and specified prescription writing procedures.
b. Start the pupil at the proper point in the instructional continua.	b. Provide learning experiences that are a challenge but permit regular progress.
c. Specify learning experiences suited to the pupil's ability and other personal qualities.	c. Vary from pupil to pupil depending upon individual differences.

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* Individually Prescribed Instruction: Outline of Basic Elements in Development and Evaluation. Learning Research and Development Center, University of Pittsburgh, May 13, 1968.

d. Are suited to the pupil's rate of learning.	d. Permit pupil to proceed at his best rate.
e. Provide guidance to the pupil so that he can secure proper materials and proceed.	e. Are interpreted and used correctly by the pupil.
f. Provide for adjustment as pupil proceeds.	f. Are modified as required.
Instructional Materials and Devices that:	**The Instructional Materials and Devices:**
a. Are referenced to a specific objective.	a. Are easily identified with the proper objective.
b. Enable the student to achieve mastery.	b. Have demonstrated instructional effectiveness.
c. Permit a maximum of independent study and individual progress.	c. Are used by pupils largely in individual independent study.
d. Permit packaging into individualized instructional sequences.	d. Are used by pupils in individualized packages.
e. Require active responses on the part of the pupil.	e. Keep the pupil actively involved.
f. Are primarily self-instructional.	f. Require a minimum of direct teacher help to pupils.
g. Are regularly revised and improved on the basis of performance data.	g. Are shown to teach more effectively as they are revised.
Teacher Classroom Activities that:	**The Teacher Classroom Activities are such that:**
a. Provide the pupil with help when he needs it.	a. There is little delay in the pupil's getting help when he needs it.
b. Provides individual help on individual problems.	b. Teacher assistance to pupils is largely on an individual basis.

c. Permit the teacher to spend considerable time in diagnosuing needs of individual pupils and in preparing prescriptions.	c. The teacher will spend some class time in examining pupil work and in developing prescriptions.
d. Reinforce the pupil's learning and attention.	d. Positive reinforcement of desirable behavior is employed.
e. Give the student considerable freedom in determining when and how he works.	e. Teachers give the students considerable freedom.
f. Facilitate progress on an individual basis.	f. Little time is spent on lectures (etc.) to the group, and individual or small group tutoring is employed.
Classroom Management Procedures that:	Classroom Management Procedures are such that:
a. Use teacher aides to score papers and tests and provide quick feedback on results.	a. Teacher aides score papers and record results in an efficient manner.
b. Permit pupils to score some of his papers.	b. Pupils score some work pages.
c. Provide for the pupil's procuring his own instructional materials.	c. Pupils procure own lesson materials.
d. Allow the pupil to decide when he has completed a lesson and is ready to have it scored.	d. Pupils decide when to have lessons scored.

Figure 2

MATHEMATICS PRESCRIPTION SHEET

STUDENT NAME

STUDENT NUMBER

SCHOOL STAMP

GRADE

ROOM

UNIT

	PRES. DATE	PRES. INIT.	SKILL NO.	PAGE NO.	INST. TECH CODES	SCORE	MAX. POINTS

CURRICULUM TEST				SC'S INIT	DAYS* WORKED IN SKILL	NOTES
PART 1		PART 2				
SCORE	%	SCORE	%			

CODES	INSTRUCTIONAL TECHNIQUE
01	TEACHER TUTOR
02	PEER TUTOR
03	SMALL GROUP (2-10)
04	LARGE GROUP (11-UP)
05	SEMINAR
06	CURR. TEXTS
07	OTHER TEXTS
08	FILM STRIPS
09	RECORDS, TAPES
10	RESEARCH
11	TUTOR OF OTHERS
12	OTHERS

CURRICULUM TEST									
ENTER SKILL NUMBER	ENTER POINTS PER SKILL	PRE	%	POST	%	POST	%	POST	%

Table I

Summary Information on Number of Lesson Pages and Instructional Alternatives Used for Selected IPI Math Objectives

Objective	No. of Students	Range of Pages	Mean No. of Pages	Alternatives Used	Percent of Alternatives*
D-Add-2	65	3-14	8.5	Booklets	97%
				Teacher Tutoring	3
				Seminar	15
				Other Texts	2
D-Add-3	72	1-9	6.0	Booklets	100%
D-Sub-3	125	3-21	13.3	Booklets	94%
				Teacher Tutoring	9.2
				Peer Tutoring	2.7
				Small Group	1.5
				Large Group	1.2
				Seminar	5.8
				Records, Tapes	1.1
				Other	1.2
D-Sub-5	147	1-25	11.8	Booklets	97%
				Teacher Tutoring	10.4
				Peer Tutoring	2.2
				Small Group	1.0
				Large Group	1.4
				Seminar	2.1
				Textbooks	1.0
				Other Text	3.1
				Other	2.0
E-Mult-5	175	5-28	13	Booklets	100%
				Teacher Tutoring	10
				Seminar	5
				Curriculum Texts	1.4
				Other Texts	1.4
				Film Strips	3.6

*It is possible to use more than a single alternative for any one objective.

Table II

Percent of Students Having 85% or More Proficiency of Each Objective as Measured by Pretest thru D-Division

Unit	Skill	Number	Percent with 85% or More Proficiency
Num-C	1	1049	87%
Num-C	3	1048	85%
Num-E	4	602	89%
PV-C	3	709	88%
PV-D	3	738	96%
PV-D	4	738	97%
PV-E	3	415	83%
Add-B	2	425	93%
Add-C	5	333	85%
Add-D	1	373	99%
Sub-C	3	425	92%
Sub-D	1	614	90%
Mult-D	1	335	96%
Mult-D	2	335	94%
Div-D	1	523	85%
Div-D	2	523	87%
Div-D	4	523	85%

Table III

Percent of Students Requiring Indicated No. of Tests
Before Showing Mastery of Each Objective in
Two Sample Math Units

Unit	Objective	% Passing CET 1	% Passing CET 3 or More	% Passing 1st Post	% Passing 3 or More Post
D-Add	2	80	0		
	3	75	0		
	4	80	0		
	5	50	13		
	6	72	0		
	7	64	7		
	8	67	0		
	All			76%	15%
E-Mult	1	50	0		
	2	100	0		
	3	100	0		
	4	80	0		
	5	0	33%		
	6	80	4%		
	8	67	8%		
	9	100	0		
	10	50	21%		
	11	60	11%		
	All			68%	21%